INTEGRATED, DURABLE, BACKLIT, ERGONOMIC, LOW PRESSURE, ELECTRONIC, INTERNET ACCESSIBLE, BIOMETRIC LOCKER SYSTEM WITH VENTILATED PLENUM, DIFFUSION PLATE, HYDROPHILIC BASE, TAMBOUR DOOR, AND SUSTAINABLE COMPONENTS

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This invention pertains to locker systems found in gymnasiums, public places, and other locations for storing personal belongings and other articles.

More particularly, the invention pertains to locker systems that are less prone to damage, that facilitate lighting of the interior of the lockers, that facilitate the ergonomic use of the lockers, that improve ventilation of the lockers, that facilitate communication of the locker users with other parties, and that reduce the likelihood the lockers can be entered illegally.

In a further respect, the invention relates to lockers that are integrated with environmental control and communication systems in building structures.

Lockers have for many years been utilized in gymnasiums, airports, and other places. Even though existing lockers are practical and in many cases advantageous to utilize, there are disadvantages or problems associated with using such lockers.

One problem is that the ventilation and air flow in a closed locker typically is minimal. Although the doors on many lockers are louvered to promote air flow into and from the locker, the air flow typically is minimal. When airflow in a locker is minimal, moisture in the locker does not readily evaporate and moisture-related and other odors tend to travel out of the locker into surrounding areas.

Another problem associated with existing locker systems is that hinged locker doors in such systems tend to be readily damaged when user pulls, slams, or leans on opened locker doors.

A further problem associated with conventional locker systems is that the lighting inside each locker is insufficient.

Still another problem associated with existing locker systems is that the lockers are susceptible to water damage in the event the floor of a gymnasium or locker room is wet and water on the contacts the bottom of the lockers.

Still a further problem associated with existing locker systems is that to a large extent they utilize resources that are not readily replenished without damaging the environment.

Yet another problem associated with existing locker systems is that the lockers in the systems do not provide a ready means for communicating with the individuals assigned to the lockers.

Yet a further problem associated with existing locker systems is that they utilize locks that are readily disabled by a skilled individual wanting to gain illegal access to the lockers.

Yet still another problem associated with existing locker systems is that they often are not ergonomically friendly.

Accordingly, it would be highly desirable to provide an improved locker system that resolves the problems set forth above in connection with conventional lockers.

Therefore, it is a principal object of the invention to provide an improved locker system for storing personal items and other articles.

A further object of the invention is to provide an improved locker system that can be integrated with existing environmental and communication systems in a building structure.

Another object of the instant invention is to provide an improved locker system that will prevent locker doors from being damaged when open.

Still a further object of the invention is to provide an improved locker system that utilizes in large part sustainable materials.

Still another object of the invention is to provide an improved locker system that provides a pneumatic system to ventilate the locker.

Yet a further object of the invention is to provide an improved locker system that uses backlighting and other light dispersing materials to illuminate the interior of the locker.

Yet another object of the invention is to provide an improved locker system that can be opened only by the individual assigned to the locker.

Yet still a further object of the invention is to provide an improved locker system that permits the individual assigned to the locker to communicate with the Internet.

A further object of the invention is to provide an improved locker system that facilitates the intercommunication of a coach with the members of his team.

Another object of the invention is to provide an improved locker system that utilizes the unique physical properties of an individual to facilitate operation of the system.

These and other, further and more specific objects and advantages of the invention will be apparent from the following detailed description of the invention, taken in conjunction with the drawings, in which:

Fig. 1 is a perspective view illustrating a locker constructed in accordance with the principles of the invention;

Fig. 2 is a perspective view illustrating the electronic control unit in the locker of Fig. 1;

Fig. 3 is a top perspective view illustrating the locker of Fig. 1 when the tambour door is opened;

Fig. 4 is a top perspective section view of the locker of Fig. 3 illustrating further construction details thereof;

Fig. 5 is a front perspective view of the locker of Fig. 3 illustrating further construction details thereof;

Fig. 6 is an exploded perspective view of the locker of Fig. 3 illustrating further construction details thereof;

Fig. 7 is a perspective view illustrating a locker system constructed in accordance with the invention;

Fig. 8 is a perspective section view illustrating air flow in the locker resulting from the pneumatic system integrated with the locker; and,

Fig. 9 is a block diagram of a control system that can be integrated and used with a locker or with a plurality of lockers.

Briefly, in accordance with my invention, I provide an improved locker

system. The locker system includes a building structure including a room having a floor and walls; and, a plurality of lockers in the room. Each of the lockers includes an interior; an air intake; an air out take; and, a pneumatic system to remove air from the interior of each of the lockers to produce a low atmospheric pressure volume in the interior of each of the lockers, the low atmospheric pressure volume causing ambient air to flow through the air intake into the interior of each of the lockers.

In another embodiment of the invention, I provide an improved locker system. The system includes a building structure including a room having a floor and walls; and, a plurality of lockers in the room. Each of the lockers includes an interior; a base fabricated from a hydrophilic material and contacting said floor; and, a door.

In a further embodiment of the invention, I provide an improved locker system. The locker system includes a building structure including a room having a floor and walls; and, a plurality of lockers in the room. Each of the lockers includes an interior; a base; a door; sides; a back; and, a light source in the locker for dispersing in the interior of the locker light produced by the light source.

In still another embodiment of the invention, I provide an improved locker system. The locker system includes a building structure including a room having a floor and walls; and, a plurality of lockers in the room. Each of the lockers includes an interior; a base; a door; and, a system for accessing the Internet.

In still a further embodiment of the invention, I provide an improved locker system. The locker system includes a building structure including a room having a floor and walls; a processing system for producing digital data signals defining a message; and, a plurality of lockers in the room. Each of the lockers includes an interior; a base; a door; and, a reception system for receiving the digital data signals. The locker system also includes a communication system for transmitting the digital data signals from the processing system to the reception system in each of the lockers.

In yet another embodiment of the invention, I provide an improved locker system. The locker system includes a building structure including a room having a floor and walls; and, a plurality of lockers in the room. Each of the lockers includes an interior; a base; a door; a lock; and, a control system for opening and closing the lock

to access the locker. The control system receives and evaluates biometric data and compares the biometric data to reference biometric data to open the lock.

In yet a further embodiment of the invention, I provide an improved locker system. The locker system includes a building structure including a room having a floor and walls; and, a plurality of lockers in the room. Each of the lockers includes an interior; a base; a door; and, sides each made from sustainable materials.

In yet another embodiment of the invention, I provide an improved locker system. The locker system includes a building structure including a room having a floor and walls and a central air conditioning system; and, a plurality of lockers in the room. Each of the lockers includes an interior having a first portion and a second portion; an air intake; an air out take; and, a duct system connected to and integrated with the central air conditioning system to direct air flow through the first portion of the interior to create low pressure in the second portion of the interior.

Turning now to the drawings, which depict the presently preferred embodiments of the invention for the purpose of illustrating the practice thereof and not by way of limitation of the scope of the invention, and in which like reference characters refer to corresponding elements throughout the several views, Figs. 1 to 6 illustrate a locker constructed in accordance with the principles of the invention and generally indicated by reference character 100.

Locker 100 includes top 12, back 25, and parallel spaced apart sides 10. The bottom of locker 100 includes panel members 7 and 8 that typically contact or are adjacent the floor 102 of a room in a building structure. Floor 102 depends from vertically oriented wall 101 (Fig. 7). Top 12 includes lock 13 adjacent the front edge 12A of top 12. Top 12 is opened or removed by opening lock 13. Top 12 can, if desired, be hinged along its rear edge 12B so that top 12 pivots along edge 12B when lock 13 is opened and top 12 is lifted upwardly.

Perforated rectangular floor panel 17 rests on panel members 7 and 8. U-shaped rubber or metal member 15 fits over and protects the leading edge of floor panel 17. Hollow quarter-round 16 extends from member 7 to member 15. As is depicted in Fig. 8, a vent 60 can be formed through quarter-round 16 (and through

member 7) to permit air to be drawn in the direction of arrow A into the open space 17A beneath floor panel 17 and upward through apertures 61 in the direction of arrow B into the interior 71 of the lower portion to locker 100. Quarter-round 16 can, like member 15, also be fabricated from rubber or some other durable material that will resist scraping, kicking, and rubbing by the shoes of individuals and by equipment that is used to clean floor 102 and that comes into contact with quarter-round 16 and member 15. The shape and dimension of quarter-round 16 and member 15 can vary as desired, as can the shape and dimension of each piece and component of locker 100.

Vertically oriented panels 74, 75 (Figs. 5 and 6) section or divide the interior 70, 71 of locker 100. Table top 19 is positioned twenty-eight to thirty-six inches above floor 102 to facilitate use by the individual or individuals assigned to locker 100. Horizontally oriented shelves 20, 22 and 26 (Fig. 4) are perforated to facilitate air flow through shelves 20, 22, 24 and to facilitate airflow in and ventilation of the interior of locker 100.

Mirror 24 rests on horizontally oriented shelf 23 (Fig. 4) and is spaced away from back 25 such that a light (not visible) can be positioned between mirror 24 and back 25 back lite mirror 24. The normal reflective tinting or coating is partially removed from the back of mirror 24 to create "openings" through which light can pass to illuminate a user's face with light emanating from the light that is positioned between the mirror and back 25. Mirror 24 also functions to diffuse light outwardly through and from the peripheral edge of the mirror in directions parallel to the rectangular planar face of the mirror.

Baskets or drawers 18 are mounted on rails (not visible) such that drawers 18 can be pulled out and pushed in in conventional fashion. The openings in wire baskets 18 facilitate the circulation of air in and through locker 100.

Plenum space 70 (Figs. 1 and 8) is formed between shelf 20 and top 12. Each rail 1 is mounted on the canted leading edge of one of sides 10. The parallel peripheral edges of tambour door 5 engage, slide along, and are guided by rails 1. A motor (not visible) mounted on locker 100 in plenum space 70 rolls and unrolls tambour door 5 on a rotatable axle 5A. When the motor is used to roll and unroll door 5, the motor and door 5 function as a lock. Door 5 can be opened and closed only by

activating the motor. When door 5 is closed, the interior 71 of locker 100 can not be accessed. When door 5 is opened, the interior 71 of locker 100 can be accessed.

If, on the other hand, door 5 is or can be manually opened (when there is no motor to open door or when the motor permits the door to be opened even when the motor is not operating), then door 5 does not function as a lock and a separate lock normally is used. Such a lock could, for example, be similar or identical to locks found on the entryway doors in residences and buildings.

Fig. 1 illustrates door 5 in the closed position.

Fig. 3 to 6 illustrate door 5 in the open position.

Clothes hanger or hook 101 is mounted on the lower portion of perforated panel member 14. A fluorescent light 30 or other light source is mounted behind (or, if desired, in front of) panel member 14. Light from light 30 travels through openings (not visible) in the bottom lip 14A of member 14 and illuminates the front or outer surface of door 5.

The perforations 14B in panel member 14 promote the flow of air through the interior 71 of member 14, as do perforations 66 (Fig. 8) in shelf 20, perforations 61 (Fig. 8) in floor panel 17, and the perforations in shelves 22 and 26.

The left hand rail 1 in Fig. 1 includes a flange on which an electronic control unit 3 is mounted with an elongate bracket 2. Control unit 3 includes a display--control screen 3A and typically also includes a microprocessor. Unit 3 can be permanently secured in place with bracket 2, or, unit 3 can be removable such that unit 3 can be removed from bracket 2 and carried to and used at remote locations and then be reinserted in bracket 2. When unit 3 is removable, unit 3 and bracket 2 includes a "hot shoe" or other means that establishes electrical contact with unit 3 when unit 3 is insert in bracket 2 and that permits data to be transmitted to and from unit 3 via bracket 2. Alternatively, data can be transmitted to and from unit 3 in wireless fashion via a transmitter--antenna unit in unit 3. The use of an electronic control unit 3 as a component of locker 100 is not necessary, but is preferred. Unit 3 can perform several functions. Unit 3 can include a touch sensitive screen 3A that permits a user to enter data and control unit 3 by pressing his finger on "buttons" or other symbols that appear

on the touch sensitive screen in accordance with instructions from a microprocessor that is in or remote from unit 3.

First, unit 3 can, before accepting various commands from an individual or before permitting an individual to otherwise make use of unit 3, carry out one or more procedures for identifying the individual. Unit 3 can, for example, require that a numerical code consisting of a selected number of specific digits be input. If the digits input match the numerical code in the reference file utilized by unit 3, then the individual can continue use of unit 3. If the digits input do not match, unit 3 does not allow the individual to use unit 3.

Or unit 3 can acquire biometric data by reading the individual's fingerprints, by doing a retinal scan, by doing a voice analysis, by doing a DNA analysis of skin cells, etc. Unit 3 compares the biometric information acquired with reference biometric information on file in the memory of unit 3 or in the memory of another unit accessible by unit 3. If the acquired biometric information matches the reference biometric information, the individual can continue using unit 3. If the acquired information does not match the reference biometric information, further use of unit 3 is prevented.

Unit 3 can communicate with other remote devices via optical fibers, via microwave or other wireless forms of communication, via direct "hard wire" connection, or by any other desired communication system.

Second, unit 3 can be equipped to allow the individual assigned to locker 100 to use unit 3 to access and use the Internet.

Third, unit 3 can include work processing software, scheduling software, or any other software for use by the individual assigned to locker 100.

Fourth, unit 3 can be equipped with a microphone and speaker and other components that permit an individual to utilize unit 3 as a telephone.

Fifth, unit 3 can be equipped to permit an individual to control the door motor that opens and closes door 5. Once, for example, unit 3 satisfactorily confirms the identity of an individual, the individual can utilize unit 3 to operate the door motor to open and close door 5.

Sixth, unit 3 can communicate with other systems that transmit data to unit 3 or receive data from unit 3. For example, the coach of an athletic team can input messages in a remote computer and then transmit the messages as appropriate to the unit 3 on each locker 100. The same message can be sent to each unit 3 on the lockers 100, or, a different message can be sent to each unit 3 on lockers 100. The messages can be transmitted via e-mail, via a computer network, or via any other desired means. The individual assigned to each locker can also utilize a unit 3 to send a message from unit 3 to the computer, television (for display on the television screen) or other apparatus of a coach or other individual. Unit 3 can includes a computer keyboard or other data input system. Unit 3 can be fabricated to receive and read or write on a CD, floppy disk, or any other desired media storage device.

One goal of the invention is to utilize sustainable materials to construct most of locker 100. Sustainable materials are materials that are obtained from a replenishable resource that does not violate or damage the environment. Recycled materials ordinarily are not considered to be sustainable materials because it requires more energy to recycle materials than to harvest and use materials from another replenishable resource. Sides 10, top 12, shelves 20, 22, 26, table top 19, drawer 21, cupboard door 27, member 14, and members 7 and 8 can be fabricated from strawboard. Strawboard is a sustainable material. Strawboard is comprised of a composition comprising the stalks and husk from wheat plus a binder. This composition is pressed together to form a board. If desired, the sustainable strawboard can be coated with a hydrophilic skin comprising a polymer or polymers or other water resistant or water proof material. Strawboard is produced without recycled materials.

Members 7 and 15 and quarter-round 16 wear because of contact with shoes and with equipment used to clean and maintain floor 102. These components are therefore preferably fabricated from a material like metal or a polymer that has a consistent homogenous composition throughout the material, or at least has a consistent homogeneous composition to a depth of one-eighth of an inch. When a component has a consistent composition throughout, wear of the material is less evident.

When top 12 is opened, the motor that opens and closes door 5 can be operated to override any command that may be in or being issued by unit 3.

The pneumatic system used to ventilate a locker or lockers 100 is important in the practice of the invention. As earlier noted, perforations 61 in floor panel 17, perforations 66 in shelf 20, and perforations in shelves 22 and 26 facilitate the circulation of air inside and through a locker 100. Fig. 8 illustrates an air circulation system in which perforations 62, 63, 63, 65 are also formed in the sides and back of a locker 100.

In Fig. 8, side 10 is replaced with hollow side 10A. Side 10A includes a horizontally oriented rib 43 that divi des the hollow space inside side 10A into a first lower volume 41 and a second upper volume 42. Air travels into interior 71 through vent 60 in the direction indicated by arrow A, and through apertures 61 in the direction indicated by arrow B, through vent opening 40 and apertures 62 in the direction indicated by arrow C, and from space 17A (underneath floor panel 17) through apertures 61 in the direction indicated by arrow B. Air from interior 71 travels through apertures 64 into upper volume 42 and thenceforth upwardly and out through vent opening 44 into the interior plenum space 70 in the manner indicated by arrow F. Air can also travel upwardly through interior 71 in the manner indicated by arrow K, and then through apertures 66 in shelf 20 and into interior plenum space 70. Air traveling into vents 63 in the manner indicated by arrow D travels upwardly and then out through apertures 65 into the plenum space 70 in the manner indicated by arrow G. The upward travel of air into plenum space 70 is promoted by developing a low pressure area in interior 71. This low pressure is produced by a flow of air traveling through openings 28A in panels 28 in the manner indicated by arrows I and J in Figs. 3 and 8. This air flow draws or suctions air from the interior 71, creates low pressure in interior 71, and promotes the incoming flow of air into interior 71 through apertures formed in floor panel 17, side 10A, back 25A, etc. Openings 28A, perforations inside the locker, etc. are engineered to insure that a low pressure area is created in the locker and air is drawn out of the locker via the air flow passing through the top (or bottom, if desired) of the locker.

An alternate method of using a flow of air to create low pressure in interior 71 is to integrate the locker system with an environmental control system (for example, an air conditioning system or humidification system) in the building structure 200 by running a length 79 of ducting over the top 12 of each locker 100. An opening 79A is cut in each top 12 in registration with a like opening cut in the ducting such that when air flows through ducting 79 in the direction of arrow M, said air flow draws air out from plenum space 70 and interior 71 and creates a low pressure area in interior 71 than promotes an incoming flow or air into interior 71 and plenum space 70 in the manner indicated by arrows A, B, C in Fig. 8. When ducting 79 is utilized, it is not necessary to form openings 28A in panels 28. Ducting 79 is part of the air conditioning system in the building structure 200 or is connection to ducting in the air conditioning system of the building 200.

If desired, the flow of air indicated by arrows I, J, M in Figs. 3 and 7 can be directed into a locker or locker to produce higher than normal pressure in interior 71 and to cause air to flow outwardly through perforations in directions opposite those indicated by arrows A, B, C, D, F, G, H. It is, however, preferred to create a low pressure area in interior 71 such that the air flow indicated by arrows I, J, and M carries moisture and odors out of the lockers and room in which the lockers are situation. The air flow I, J, M can be exhausted to the ambient atmosphere surrounding the building structure in which the lockers 100 are located, or, can be dried, de-odorized or otherwise processed and directed back into the building structure occupied by the lockers 100. The flow of air from the interior 71 into plenum space 70 can be facilitated by mounting a fan or other air flow control apparatus in each locker 100. For example, a fan can be mounted below opening 79A and direct air from plenum space 70 (and therefore from interior 71) directly into ducting 79.

Irrespective of whether the atmospheric air pressure produced in interior 71 is greater or less than normal atmospheric pressure, it is important in the practice of the invention to produce an air pressure gradient or differential that promotes the flow of air through interior 71 to remove moisture and odors from interior 71.

An odor absorbing element or pad 70A can be inserted on top of shelf 20

in the manner indicated by arrow L in Fig. 8 to remove odors from air being drawn into and out of plenum space 30. Pad 70A can include charcoal, potassium nitrate, sodium bicarbonate, or any other desired odor absorbing components. Odor absorbing materials can be positioned in locker 100 at any desired location, although it is preferred to place such materials at locations where air is forced to flow through the materials.

Fig. 9 illustrates a control system that can be incorporated in control unit 3. The system includes a memory 81 and controller 80. Memory 81 includes Internet data 85, message data 86, telephone data 87, and pneumatic data 94. Control 80 includes Internet sub-routine 82, message sub-routine 83, telephone sub-routine 84, and pneumatic sub-routine 93. Display 90 can, for example, comprise the display screen 3A on control unit 3. Data input 91, 94, 92 comprises a keyboard or any other means for inputting data. The communication system 18 can comprise any communication system, but typically is a remote computer used to send messages and audio data (i.e., telephone calls) to control 80 by e-mail or other means. The pneumatic system includes the motor used to open and close door 5 (which motor typically is electric) and includes the system used to control the flow of air into and out of interior 71 and interior plenum space 70.

In use, lockers 100 are provided and are installed, typically with members 7 and 8 on or adjacent floor 102 and a wall 101 of a building structure 200. Lockers 100 may, however, be stacked one on top of the other in conventional fashion, or, may be suspended from the ceiling above floor 102 and away from a wall 101.

Control unit 3 in each locker 100 is programmed with reference data defining the fingerprint of the individual assigned to the locker.

The door 5 in each locker 100 can only be opened (unless the override of the motor is used by opening top 12) by operating with unit 3 the motor 95 that is mounted in plenum 70 and that controls the door 5. Unit 3 is integrated in a communication system in the building structure 200 by connecting unit 3 to the computer (communication system 18) of the head coach of the team and by connecting to the Internet 88 using telephone lines or other communication means in the building

structure 200. Unit 3 is also integrating in a speaker system in the building structure 200 and includes a speaker and a microphone that permits the user to make telephone calls and that connects the user with a speaker and microphone in the coach's office.

The user approaches his (or her) assigned locker 100. He places his thumb against the display screen 3A. Unit 3 reads the user's thumb print and compares that gathered biometric data with reference data stored in the memory 81 of unit 3. The gathered biometric data corresponds to the reference data. The message:

"IDENTIFICATION CONFIRMED. PROCEED"

appears on display screen 3A. The user inputs data 91 by operating a small keyboard (not visible) on unit 3 to see if unit 3 has received any messages. The message:

"YOU'VE GOT MAIL"

appears on display screen 3A. The user operates the key board to retrieve the message. The message says:

"PRACTICE THURSDAY. 5 AM. SOUTH FIELD."

The controller in unit 3 utilizes message data 86 and message sub-routine 83 to enable the user to access and read the message.

The user operates the key board to place a telephone call and depresses numerical keys on the key board to dial 602 494 8700. The phone call goes through. Via the speaker in unit 3, the user hears the receptionist at Heuristic Design Labs say:

"HEURISTIC DESIGN LABS. MAY I HELP YOU?"

The use responds into the microphone in unit 3:

"THIS IS TIM ADKINS. CAN I RESCHEDULE MY 2:00 APPOINTMENT TOMORROW TO 1:00?"

Via the speaker in unit 3, the user hears the receptionist at Heuristic Design Labs say:

"YES. I HAVE RESCHEDULED YOU."

The user says:

"THANK YOU."

and hangs up. The controller uses telephone data 87 and telephone sub-routine 84 to enable the user to make the foregoing telephone call.

The user operates the key board on unit 3 to access the Internet. Once

the Internet is accessed, the user accesses e-mail and sends his coach an e-mail. The user then signs off from the Internet. The controller utilizes Internet data 85 and Internet sub-routine 82 to enable the user to access and sign off from the Internet 88.

The user enters data in the key board directing the controller to open door 5. The controller utilizes pneumatic data 94 and pneumatic sub-routine 93 to send a command to the door motor 95 to open door 5 from the closed position of Fig. 1 to the open position of Figs. 3 to 5. The user places some items in locker 100 and operate the key board to close door 5. The controller commands the door motor 95 to close door 5.

The user had been out-of-town for a month and had shut off the ventilation through his locker 100 by using unit 3 to operate a motor 96 (Fig. 9) to close a louver cover over opening 79A so that duct 79 could not withdraw air from interior 71. The user uses unit 3 to cause the controller to operate the duct motor 96 to open the louver cover over opening 79A. The controlled utilizes pneumatic data 94 and pneumatic sub-routines 93 to generate a command that causes the duct motor 96 to open opening 79A.

In Fig. 1 wear molding 15 functions to protect the locker 100 from being scratched, dented or otherwise damaged by vacuums or other articles that are on or adjacent the floor and may come into contact with locker 100. In Fig. 2, reference character 6 identifies the left track or channel for door 5. In Fig. 1, reference character 11 identifies the rear or back panel of locker 100.

Having described my invention in such terms as to enable those of skill in the art to make and practice it, and having described the presently preferred embodiments thereof, I Claim: